

What is claimed is:

1. A client apparatus for preparing streaming media received over a non-deterministic delay network for playback or distribution which comprises:
  - a buffer which stores data corresponding to the streaming media;
  - 5 a time-scale modification system that time-scale modifies data output from the buffer at a time-scale modification playback rate;
  - a rate determiner that determines the time-scale modification playback rate over an interval to control an amount of data in the buffer; and
  - a user interface which receives a user requested time-scale modification
  - 10 playback rate.
2. The client apparatus of claim 1 wherein the rate determiner determines the time-scale modification playback rate utilizing the user requested time-scale modification playback rate.
3. The client apparatus of claim 2 wherein the user interface further
- 15 comprises a graphical interface.
4. The client apparatus of claim 3 wherein the graphical interface further displays one or more of the user requested time-scale modification playback rate, and the time-scale modification playback rate.
5. The client apparatus of claim 5 wherein the graphical interface
- 20 further displays a range of time-scale modification playback rates which are determined to provide uninterrupted playback.
6. The client apparatus of claim 1 wherein the rate determiner determines the time-scale modification playback rate as a non-linear function of the amount of data.
- 25 7. A method for preparing streaming media received over a non-deterministic delay network at a client device for playback or distribution which comprises the steps of:
  - receiving the streaming media at the client device;
  - determining a measure of an arrival rate and a measure of a data
  - 30 consumption rate of the received streaming media;

determining a measure of mismatch between the arrival measure and the consumption measure; and

utilizing time-scale modification to mitigate the effects of the mismatch; wherein:

5 the arrival measure is determined as a function of an arrival rate of data in a buffer; and

the consumption measure is determined as a function of a use rate of data by a playback system or a distribution system.

8. A method for preparing streaming media received over a non-  
10 deterministic delay network at a client device for playback or distribution which comprises the steps of:

receiving the streaming media at the client device;

determining a measure of an arrival rate and a measure of a data consumption rate of the received streaming media;

15 determining a measure of mismatch between the arrival measure and the consumption measure; and

utilizing time-scale modification to mitigate the effects of the mismatch; wherein the arrival rate is determined using time-stamps for arriving data.

9. A method for preparing streaming media received over a non-  
20 deterministic delay network at a client device for playback or distribution which comprises the steps of:

receiving the streaming media at the client device;

determining a measure of an arrival rate and a measure of a data consumption rate of the received streaming media;

25 determining a measure of mismatch between the arrival measure and the consumption measure; and

utilizing time-scale modification to mitigate the effects of the mismatch; wherein the arrival rate is determined by monitoring data arrival times and data packet sizes.

30 10. A method for playback of streaming media received over a non-deterministic delay network at a client device which comprises steps of:

- receiving the streaming media at the client device in a buffer;  
playing back the streaming media;  
determining a measure of an arrival rate and a measure of a data  
consumption rate of the received streaming media;
- 5                   determining a time-scale modification playback rate considering one or  
more of the measure of arrival rate, the measure of a data consumption rate, and user input  
time-scale modification playback rate requests;  
utilizing time-scale modification to mitigate underflow or overflow in the  
buffer, or disruption in playback; and
- 10                  providing an indication of a current time-scale modification playback rate to  
the user.
11.       The method of claim 10 which further comprises steps of:  
providing an indication of a user requested time-scale modification  
playback rate.
- 15                  12.       The method of claim 10 wherein the step of playing back comprises  
associating a time-scale modification playback rate with each entry in a playback buffer  
queue.
13.       The method of claim 10 wherein the indication comprises a function  
of recent time-scale modification playback rates.
- 20                  14.       The method of claim 10 wherein the step of utilizing comprising  
ignoring or modifying the user input time-scale modification playback rate when it would  
interfere with providing continuous playback.
15.       A method for preparing streaming media received over a non-  
deterministic delay network at a client device for playback or distribution which comprises
- 25   the steps of:  
receiving the streaming media at the client device;  
determining a measure of an arrival rate and a measure of a data  
consumption rate of the received streaming media;  
determining a measure of mismatch between the arrival measure and the
- 30   consumption measure; and  
utilizing time-scale modification to mitigate the effects of the mismatch;

wherein the step of utilizing comprises determining a maximum time-scale modification playback rate that can be used over a reporting time interval without draining a buffer that receives the streaming media.

16. The method of claim 15 wherein the maximum time-scale  
5 modification playback rate is determined as a function of the arrival measure, the consumption measure, an amount of data in the buffer, and the time interval.

17. A method for preparing streaming media received over a non-  
deterministic delay network at a client device for playback or distribution which comprises the steps of:

10 receiving the streaming media at the client device;  
determining a measure of an arrival rate and a measure of a data  
consumption rate of the received streaming media;  
determining a measure of mismatch between the arrival measure and the  
consumption measure; and  
15 utilizing time-scale modification to mitigate the effects of the mismatch;  
wherein the step of utilizing comprises determining a minimum time-scale  
modification playback rate that can be used over a reporting time interval without  
overflowing a buffer that receives the streaming media; wherein the minimum time-scale  
modification playback rate is determined as a function of the arrival measure, the  
20 consumption measure, an amount of data in the buffer, and the time interval.

18. A method for playback of streaming media received over a non-  
deterministic delay network at a client device which comprises steps of:

receiving the streaming media at the client device, which client device  
includes a CPU;  
25 playing back the streaming media;  
determining a measure of CPU availability;  
determining a time-scale modification playback rate as a function of the  
measure of CPU availability; and  
utilizing time-scale modification to prepare the streaming media for  
30 playback.